

OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **HIGHLAND LAKE, STODDARD** the program coordinators recommend the following actions.

NORTH STATION

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a, also a measure of algal abundance, in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) show a *fairly stable yet worsening* in-lake chlorophyll-a trend since 1996. Mean chlorophyll-a concentrations remain below the NH mean reference line, but have been increasing. The increase in rain the state experienced this summer seems to have affected the lake by increasing the nutrient input and therefore, increasing algal growth. Chlorophyll concentrations were elevated above the NH mean reference line in August this season, and this seems to have been caused by an increase in phosphorus concentrations in the epilimnion. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external and internal sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.
- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows a *slightly improving* trend in lake transparency. Transparency remained relatively uniform this season, but dropped significantly from the 1999 season. The decrease in water clarity might have been caused by the increase in algal abundance and the increase in nutrients being washed into the lake from the surrounding watershed. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually

cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show a *stabilizing* trend for the upper water layer, and a *slightly worsening* trend for the lower water layer. Epilimnetic phosphorus concentrations remained below the NH median again this season. The August results were elevated and could have been caused by rainy conditions increasing the amount of phosphorus through runoff and input from the inlets. Hypolimnetic phosphorus concentrations were also elevated in August due to the extremely high turbidity of the sample. Contamination from bottom sediment can raise phosphorus concentrations and yield inaccurate results. Oxygen depletion in the hypolimnion also releases phosphorus bound to the sediments into the water column and can cause an increase in hypolimnetic phosphorus concentrations. This is the main cause of the slightly elevated September phosphorus concentrations, and August levels most likely would have resemble those of September had the sample not contained bottom sediment. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- Several problems were noted in the NHDES lab this summer regarding sample bottles from Highland Lake in Stoddard. Once, two TP bottles were marked as the same station and then one station was missing for TP. Also, when we visit the lake next summer we would like to meet with all of the monitors who normally gather the in-lake and tributary samples. This is to ensure that the samples are being collected properly and to answer any questions the monitors might want to ask. We understand that many of the volunteers at Highland Lake are not permanent residents of the lake and have jobs that will not allow them to meet with us during the week. If a majority of the volunteers find it is very near impossible to do so, we would be willing to visit the lake on a Sunday afternoon. Remember, our samples need to be analyzed within 24 hours of being collected. Please contact the VLAP Coordinator at (603) 271-2658 in the spring to set up an appointment for our visit. In recent years our visit has been

towards the end of the summer, so in 2001 it might be useful to have us come to Highland Lake in the early part of the summer to compare dissolved oxygen readings.

- Conductivity in North Inlet and Dead Brook was back to normal this season (Table 6). The return of rainfall helped to increase stream flow and flushing rate. This in turn led to a decrease in the accumulation of salts and minerals in the streams, which decreased conductivity. We are pleased to report that conductivity returned to normal levels indicating that human impacts are being minimized.
- **Please note** in June this summer phosphorus levels were found to be less than 5 µg/L in Kennedy Brook. The NHDES Laboratory Services adopted a new method of analyzing total phosphorus this year and the lowest value that can be recorded is 'less than 5 µg/L'. If this caused an increase in the average phosphorus for either of the layers we would like to remind the association that a reading of 5 µg/L is still considered low for New Hampshire's waters.
- Total phosphorus concentrations were high in July for Barden Pond Bk. (Table 8). With the rainfall prior to testing we would suspect that the stream flow was sufficient to obtain a clean sample, however, it seems that this was not the case. The turbidity of the sample indicates that the sample was contaminated with organic debris which normally has phosphorus bound to it, and which likely caused the elevated phosphorus levels. Please be careful to only sample streams that are flowing and that have a sufficient flow to obtain a clear sample.
- The process of decomposition in the sediments depletes dissolved oxygen on the bottom of thermally stratified lakes. As bacteria break down organic matter, they deplete oxygen in the water. When oxygen gets below 1 mg/L, phosphorus normally bound up in the sediments may be released into the water column, a process that is referred to as *internal loading*. Depleted oxygen in the hypolimnion usually occurs as the summer progresses. Oxygen was depleted in the last three meters of the lake by August this season. This explains the higher phosphorus in the hypolimnion (lower water layer) versus the epilimnion (upper layer). Since an internal source of phosphorus to the lake is present, limiting or eliminating external phosphorus sources in the lake's watershed is even more important for lake protection.
- E. coli concentrations in Carr Brook and the South Cove Boat Landing were elevated above 200 counts per 100 mL in July this season. These concentrations are above the state standard of 88 counts per 100 mL set for Public Bathing Places (See Other Monitoring Parameters). In the past, E. coli has been elevated due to a geese problem in those sections of the lake. Monitors did not note if

the geese had returned or if residents were continuing to feed the geese, which contributes to the problem. Monitors did note, however, that there was a rainstorm prior to testing in July. Carr Brook is fed by Crescent Pond, which also is noted for having a geese problem. The rain likely flushed bacteria from Crescent Pond into Carr Brook. Bacteria concentrations were not elevated on any other sampling date, however these are single sampling events that represent one day. We encourage monitors of Highland Lake to continue sampling these sites and to record any waterfowl present on the Field Data Sheet. We also recommend testing after rains or when the water table is high so we can have a better idea as to the source of the elevated *E. coli* concentrations.

- Monitors were concerned in August about possible septic system failure and high *E. coli* concentrations. All bacteria results were all very low at the sites tested (Table 12). If residents are concerned about septic system impacts, testing when the water table is high or after rains is best. Please consult the Other Monitoring Parameters section of the report for the current standards for *E. coli* in surface waters. During that time a frog suspected of having malformities was returned to DES. The frog was inspected by a biologist and appeared to have an injury behind the right eye; no mutations were found. We encourage the volunteers to continue their diligent efforts when suspecting a problem in or around the lake. If you would like more information about malformed frogs please contact Angie Archer of the Biomonitoring Section at 271-8800.

NOTES

- Monitor's Note (6/25/00): Extreme amount of rain in May and June. Lake level came down this last week to just about normal level. A large beaver dam in the middle of Crescent Pond.
- Monitor's Note (7/16/00): Two inches of rain occurred during the night and early Sunday morning.
- Monitor's Note (8/13/00): Depth of water at North Station 26 ft.
- Biologist's Note (8/13/00): Samples not run within 24 hours. Questionable phosphorus result for hypolimnion.
- Monitor's Note (9/17/00): Approximately 1 inch of rain occurred on Friday 9/15/00.

SOUTH STATION

FIGURE INTERPRETATION

- Figure 1: The chlorophyll-a concentrations at the South Station have *stabilized* in the past few seasons. Like the North Station, there was

an increase in algal abundance in August and is also likely due to an increase in epilimnetic phosphorus concentrations at that time. Chlorophyll concentrations have remained below the NH mean reference line since 1998.

- Figure 2: Water clarity has remained relatively *stable* in the South Station. Transparency results were lower this season, but were uniform for the summer months. The rain likely washed in excess nutrients and caused more turbid waters in this station.
- Figure 3: Phosphorus concentrations in the epilimnion and hypolimnion are still *improving* in the South Station. Phosphorus concentrations in the epilimnion increased as the summer progressed. Monitors noted rain events before sampling during those months, and could be the cause of the increase seen. Hypolimnetic phosphorus results were stable and there was no sediment contamination of the samples.

OTHER COMMENTS

- The pH (Table 4) and the acid neutralizing capacity (ANC) (Table 5) of the epilimnion were very low in August. The samples sat overnight and were not run within 24 hours, which can affect the pH and ANC of the samples. The pH and ANC are the first samples run because it is critical to record these values before the air in the bottles starts to change the pH of the water.
- Dissolved oxygen was again high at all depths of the lake (Table 9). As stratified lakes age, oxygen is depleted in the lower layer by the process of decomposition. The lack of this aging indicator is a sign of the lake's overall health.

NOTES

- Monitor's Note (6/25/00): Dam done at 8:05a.m. 7 ft. of water.
- Monitor's Note (7/16/00): 2 inches of rain occurred Saturday night and Sunday morning prior to testing.
- Monitor's Note (8/13/00): Depth of water at South Station 12 ft., depth of water at Dam 7 ft.
- Biologist's Note (8/13/00): Samples not run within 24 hours.
- Monitor's Note (8/14/00): Raining while sampling. Chlorophyll-a not done.
- Monitor's Note (9/17/00): Approximately 1 inch of rain Friday 9/15/00.

USEFUL RESOURCES

A Boater's Guide to Cleaner Water, NHDES pamphlet, (603) 271-3503 or www.state.nh.us

Aquatic Plants and Their Role in Lake Ecology, WD-BB-44, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, NHDES-WD 97-8, NHDES Booklet, (603) 271-3503

Bacteria in Surface Waters, WD-BB-14, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Water Sampling Protocol for E. coli Testing, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

A Brief History of Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes, WD-BB-9, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Septic Systems and Your Lake's Water Quality, WD-BB-11, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Native or Naturalized Shoreland Plantings for New Hampshire. NHDES Shoreland Protection Program. (603) 271-3503

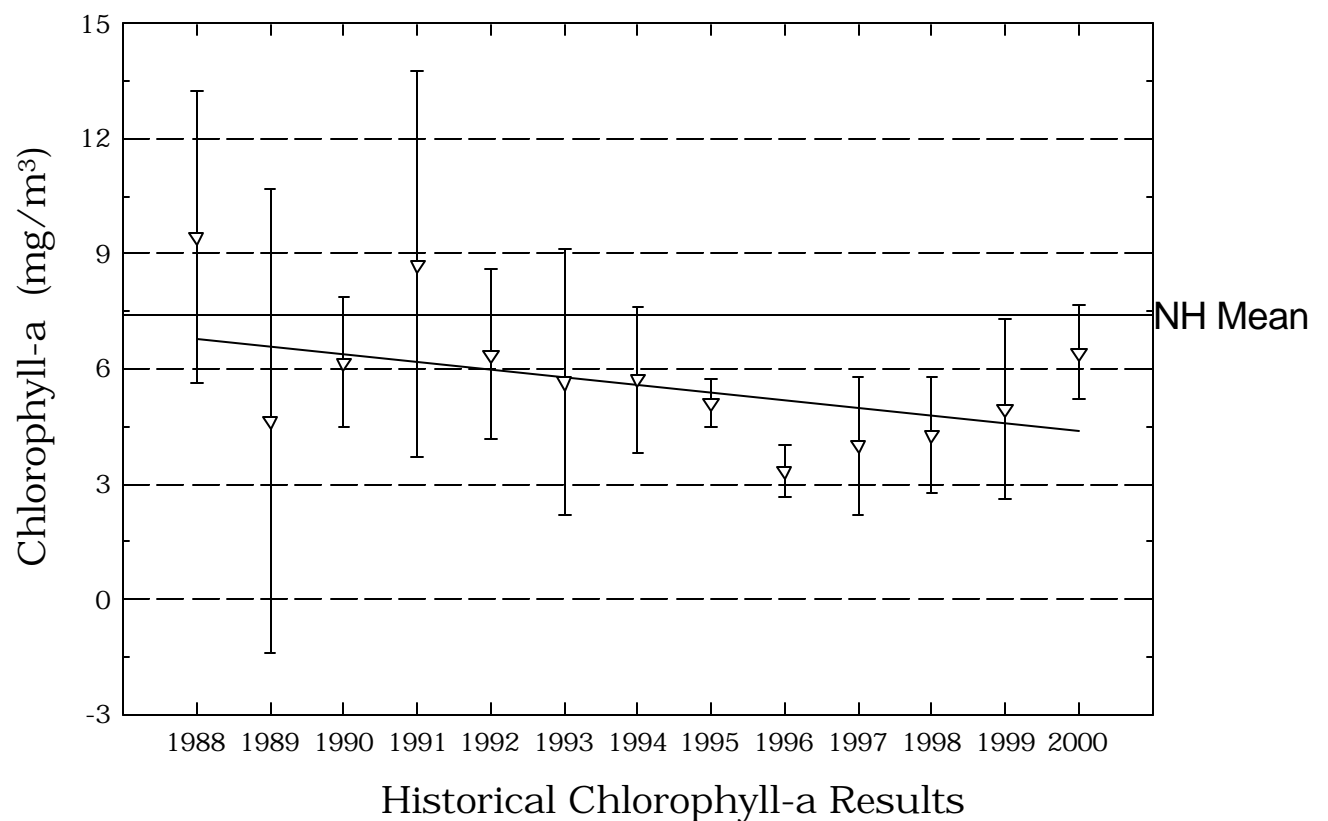
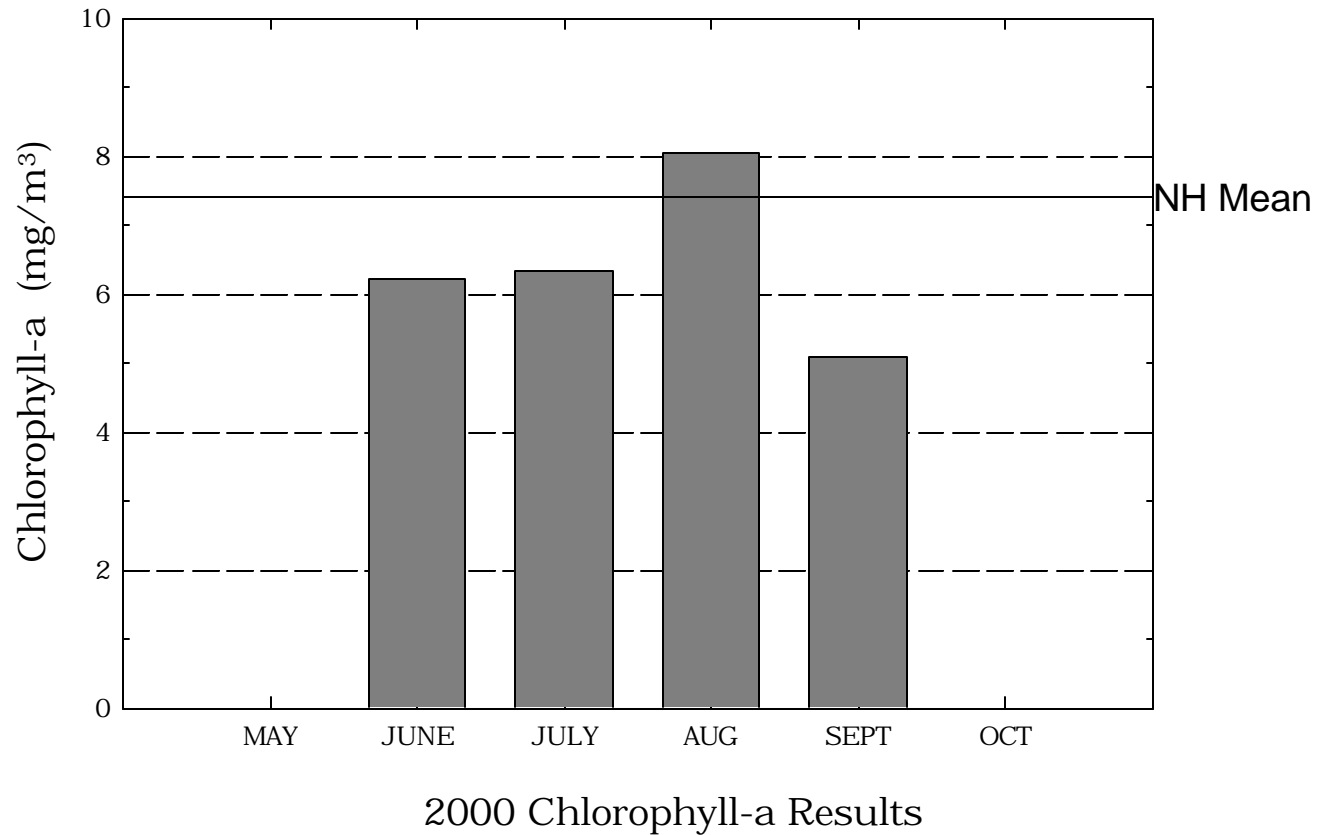
Clean Water in Your Watershed. Terrene Institute, 1993. (800) 726-5253, or www.terrene.org

The Watershed Guide to Cleaner Rivers, Lakes, and Streams, Connecticut River Joint Commissions, 1995. (603) 826-4800

Law Prohibits Exotic Aquatic Plants, WD-BB-40, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

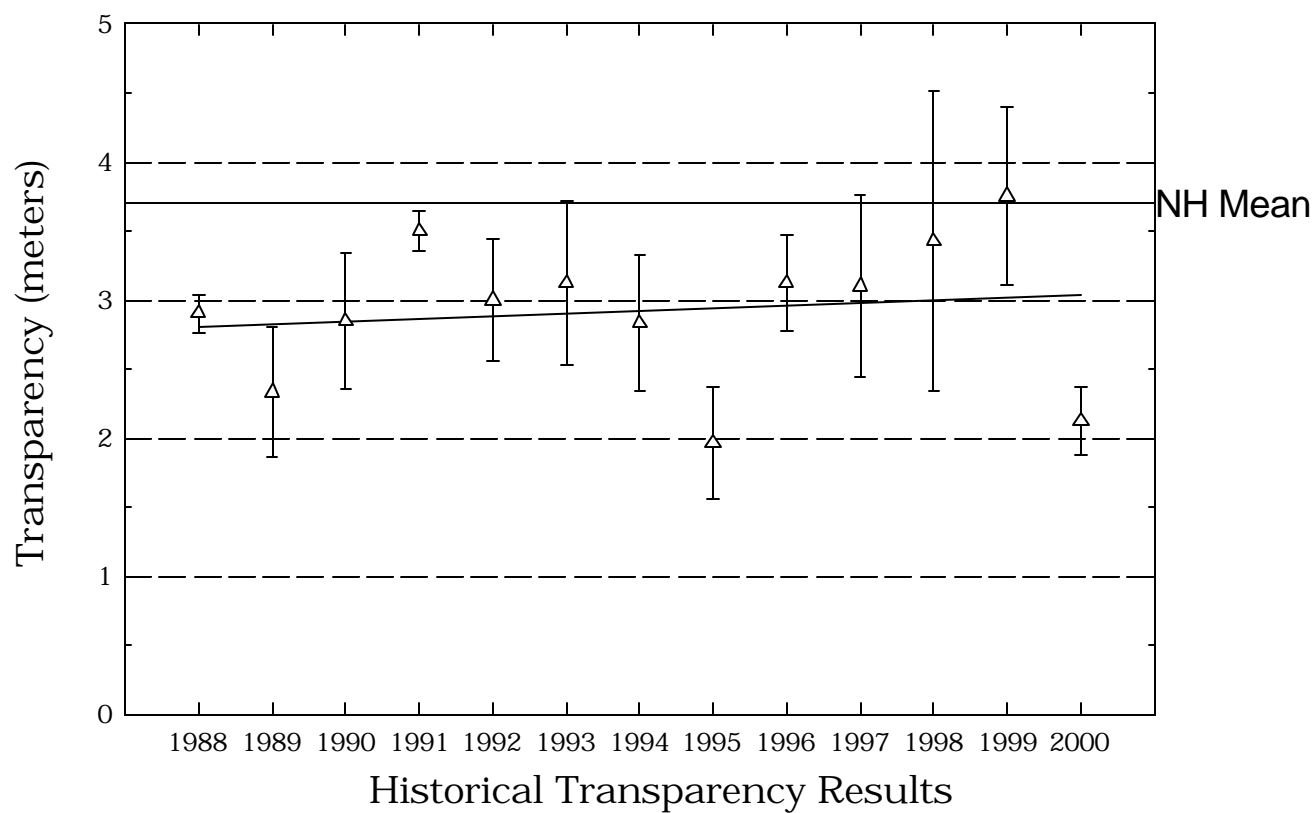
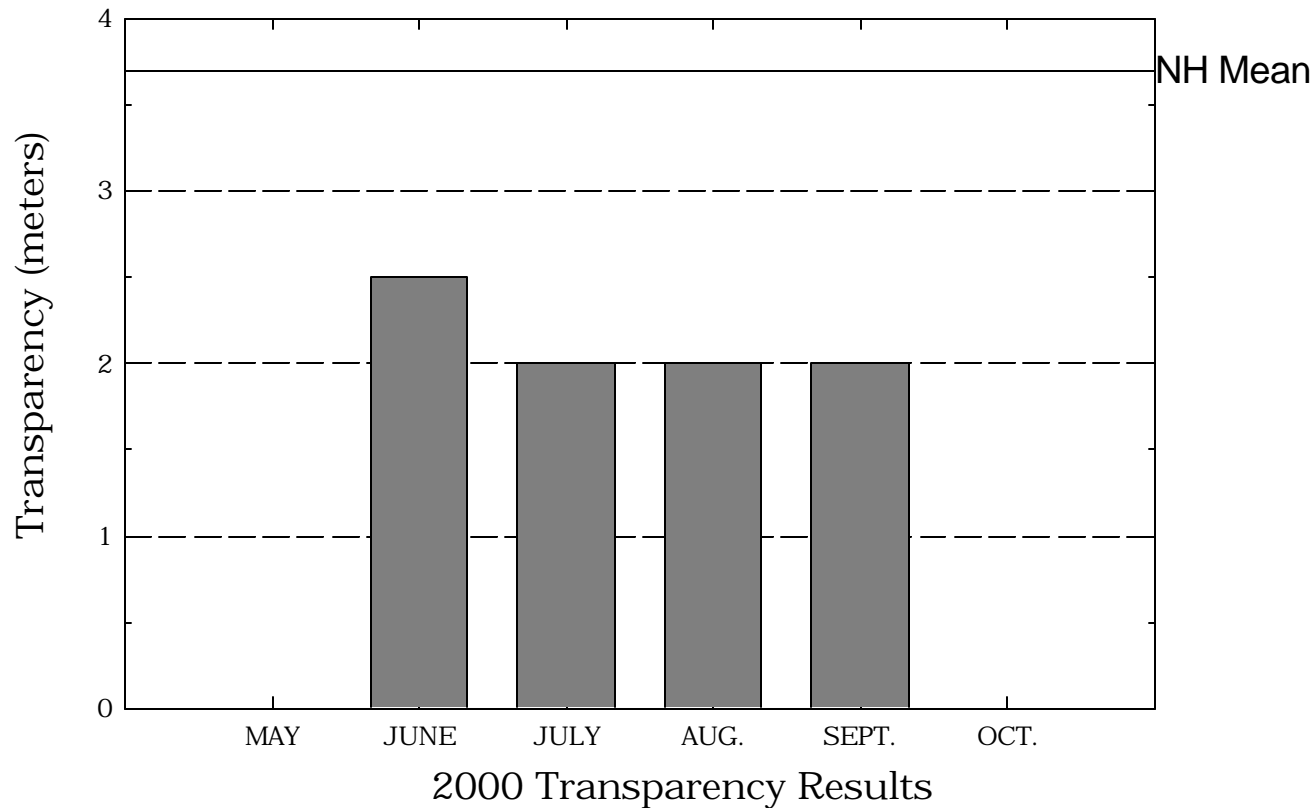
Highland Lake, North Station

Figure 1. Monthly and Historical Chlorophyll-a Results



Highland Lake, North Station

Figure 2. Monthly and Historical Transparency Results



Highland Lake, North Station

Figure 3. Monthly and Historical Total Phosphorus Data.

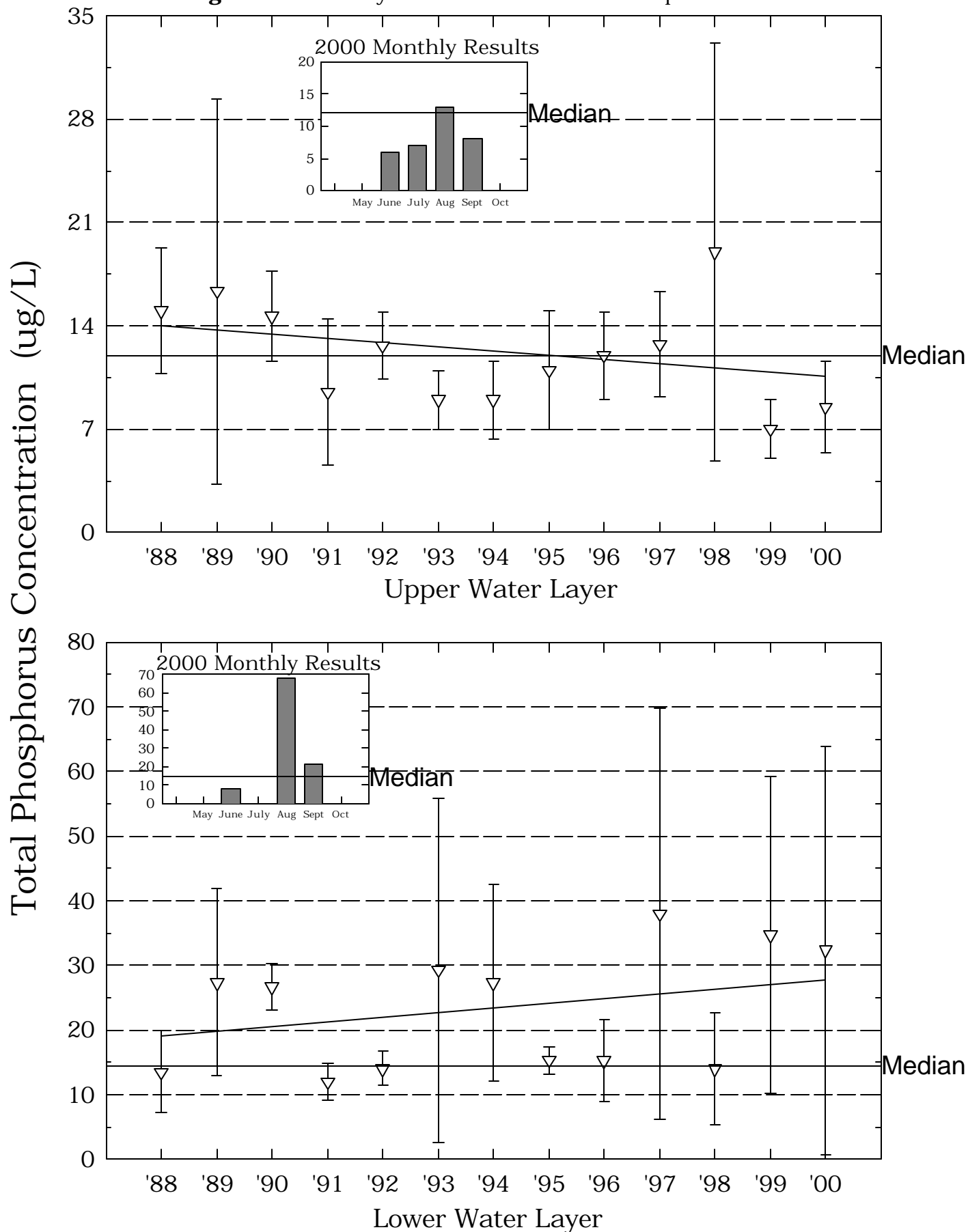


Table 1.**HIGHLAND LAKE, NORTH
STODDARD****Chlorophyll-a results (mg/m³) for current year and historical
sampling periods.**

Year	Minimum	Maximum	Mean
1988	6.76	12.13	9.44
1989	0.21	11.54	4.64
1990	4.36	7.75	6.17
1991	5.17	12.28	8.72
1992	4.01	8.41	6.37
1993	2.37	9.87	5.66
1994	4.20	7.87	5.73
1995	4.76	5.81	5.11
1996	2.73	4.20	3.34
1997	1.80	5.50	4.00
1998	2.54	5.67	4.27
1999	2.39	7.01	4.96
2000	0.90	8.06	5.37

Table 2.

**HIGHLAND LAKE, NORTH
STODDARD**

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
06/16/1988	ASTERIONELLA	30
	TABELLARIA	23
	RHIZOLENIA	19
06/13/1989	ASTERIONELLA	26
	ANABAENA	26
07/10/1990	ASTERIONELLA	92
06/25/1991	ASTERIONELLA	56
	TABELLARIA	35
06/10/1992	UROGLENOPSIS	60
	ANABAENA	28
06/30/1993	ASTERIONELLA	51
	TABELLARIA	45
09/13/1993	PERIDINIUM	30
	MICROCYSTIS	23
07/25/1994	ASTERIONELLA	26
	TABELLARIA	26
	DINOBRYON	22
06/16/1995	MALLOMONAS	24
	TABELLARIA	21
	CHRYSPHAERELLA	16
06/28/1996	MALLOMONAS	37
	ASTERIONELLA	24
	TABELLARIA	5
08/17/1997	ASTERIONELLA	42
	TABELLARIA	25
	CHRYSPHAERELLA	17

Table 2.

**HIGHLAND LAKE, NORTH
STODDARD**

**Phytoplankton species and relative percent abundance.
Summary for current and historical sampling seasons.**

Date of Sample	Species Observed	Relative % Abundance
08/16/1998	DINOBRYON	34
	MALLOMONAS	28
	ASTERIONELLA	11
08/13/2000	TABELLARIA	35
	CHRYSOSPHAERELLA	30
	ASTERIONELLA	13

Table 3.**HIGHLAND LAKE, NORTH
STODDARD****Summary of current and historical Secchi Disk
transparency results (in meters).**

Year	Minimum	Maximum	Mean
1988	2.8	3.0	2.9
1989	1.8	2.7	2.3
1990	2.5	3.2	2.8
1991	3.4	3.6	3.5
1992	2.5	3.3	3.0
1993	2.3	3.7	3.1
1994	2.5	3.4	2.8
1995	1.5	2.2	1.9
1996	2.7	3.5	3.1
1997	2.4	4.0	3.1
1998	2.5	5.0	3.4
1999	3.0	4.5	3.7
2000	2.0	2.5	2.1

Table 4.**HIGHLAND LAKE, NORTH
STODDARD**

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
BARDEN POND BK	1988	5.50	6.41	5.75
	1989	5.64	6.34	5.83
	1990	5.47	6.55	5.80
	1991	5.50	6.40	5.87
	1992	5.90	6.10	6.01
	1993	6.08	6.70	6.37
	1994	6.23	6.61	6.38
	1995	5.52	6.48	5.90
	1996	5.97	6.54	6.15
	1997	5.84	6.27	6.06
	1998	5.13	6.34	5.64
	1999	5.73	6.28	5.97
	2000	5.80	6.60	6.09
BAZOCEN POND	1997	6.06	6.06	6.06
CARR BROOK	1989	6.43	6.82	6.58
	1990	6.06	6.68	6.35
	1991	6.20	6.80	6.49
	1992	6.35	6.53	6.42
	1993	6.28	6.60	6.46
	1994	6.20	6.59	6.33
	1995	5.67	6.65	6.05
	1996	5.97	6.23	6.10

Table 4.

**HIGHLAND LAKE, NORTH
STODDARD**

**pH summary for current and historical sampling seasons.
Values in units, listed by station and year.**

Station	Year	Minimum	Maximum	Mean
DAM COMPOSITE	1997	6.08	6.59	6.28
	1998	6.14	6.48	6.28
	1999	6.01	6.41	6.20
	2000	5.95	6.35	6.10
DAM OUTLET	1997	8.16	9.52	8.52
DAM	1989	5.96	6.24	6.11
	1990	6.00	6.23	6.08
DEAD BROOK	2000	5.97	5.97	5.97
DEAD BROOK	1989	5.86	6.08	5.96
	1990	5.55	6.16	5.82
	1991	5.60	6.28	5.91
	1992	5.96	6.13	6.02
	1993	6.08	6.35	6.21
	1994	5.75	6.56	5.94
	1995	5.43	6.76	5.82
	1996	5.67	6.24	5.94
	1997	5.98	6.22	6.09
	1998	5.86	6.11	6.01
	1999	5.84	6.19	6.02
	2000	5.89	6.16	6.05

Table 4.**HIGHLAND LAKE, NORTH
STODDARD**

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
EPILIMNION	1988	6.03	6.21	6.11
	1989	5.97	6.28	6.11
	1990	5.66	6.19	5.91
	1991	6.20	6.38	6.28
	1992	6.30	6.34	6.32
	1993	6.04	6.40	6.15
	1994	6.02	6.28	6.14
	1995	6.36	7.17	6.62
	1996	5.76	6.25	6.02
	1997	5.82	6.34	6.01
	1998	6.00	6.15	6.06
	1999	5.53	6.58	5.87
	2000	6.10	6.42	6.24
FREEZELAND BK	1989	4.55	5.02	4.73
	1990	4.56	5.11	4.81
	1991	4.30	4.78	4.48
	1997	6.04	6.04	6.04
HYPOLIMNION	1988	5.62	6.11	5.80
	1989	5.72	5.90	5.81
	1990	5.60	6.16	5.72
	1991	5.66	6.10	5.83
	1992	5.72	6.03	5.82

Table 4.**HIGHLAND LAKE, NORTH
STODDARD**

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
	1993	5.58	6.22	5.91
	1994	5.61	6.06	5.81
	1995	5.85	6.02	5.90
	1996	5.35	6.28	5.64
	1997	5.77	5.85	5.82
	1998	5.75	6.20	5.91
	1999	5.76	5.89	5.83
	2000	5.70	6.35	5.89
KENNEDY BK				
	1989	6.76	6.78	6.77
	1990	5.42	6.30	5.73
	1991	5.40	6.30	5.77
	1992	5.94	6.10	6.02
	1993	6.03	6.62	6.31
	1994	6.22	6.44	6.31
	1995	5.80	6.66	6.12
	1996	6.19	6.75	6.41
	1997	6.11	6.19	6.15
	1998	5.51	6.47	5.91
	1999	5.82	6.17	6.01
	2000	5.62	6.14	5.91
METALIMNION				
	1988	5.82	5.88	5.85
	1989	5.73	6.19	5.93
	1990	5.66	5.74	5.70
	1991	5.74	5.74	5.74

Table 4.

**HIGHLAND LAKE, NORTH
STODDARD**

**pH summary for current and historical sampling seasons.
Values in units, listed by station and year.**

Station	Year	Minimum	Maximum	Mean
	1992	5.98	6.23	6.08
	1993	5.60	5.96	5.80
	1994	5.46	6.11	5.68
	1995	5.88	5.97	5.94
	1996	5.53	5.91	5.72
	1997	5.75	6.00	5.83
	1998	5.49	6.17	5.75
	1999	5.83	6.02	5.94
	2000	5.69	6.65	5.91
N OF HIDDEN LAKE RD				
	1997	6.21	6.21	6.21
NEW NORTH OUTLET				
	1991	5.20	5.20	5.20
NORTH COMPOSITE				
	1996	6.19	6.19	6.19
	1997	9.49	9.49	9.52
NORTH INLET				
	1988	5.78	6.39	5.99
	1989	5.88	6.38	6.04
	1990	5.56	6.47	5.92
	1991	5.80	6.60	6.14
	1992	6.20	6.23	6.22
	1993	6.30	6.77	6.51
	1994	6.26	6.50	6.33

Table 4.

**HIGHLAND LAKE, NORTH
STODDARD**

pH summary for current and historical sampling seasons.

Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
NORTH OUTLET	1995	5.84	6.68	6.19
	1996	6.15	6.76	6.29
	1997	5.95	6.99	6.18
	1998	5.47	6.48	5.94
	1999	5.76	6.32	6.07
	2000	6.08	6.45	6.24
OUTLET COVE	1989	4.47	5.27	4.71
	1997	6.28	6.28	6.28
OUTLET	1988	6.02	6.23	6.11
	1988	5.10	5.98	5.35
PICKEREL COVE BK	1989	5.67	5.99	5.77
	1990	5.56	6.04	5.76
	1991	5.30	6.00	5.62
	1996	5.62	6.03	5.84
	1997	5.65	5.97	5.78
	1998	5.37	5.67	5.50
	1999	5.49	5.94	5.70
	2000	5.59	5.76	5.68

Table 4.**HIGHLAND LAKE, NORTH
STODDARD**

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
RICE BK TRIB	1996	5.98	6.23	6.12
	1998	5.70	6.15	5.92
	1999	5.23	6.14	5.69
	2000	5.20	6.11	5.48
RICE BK	1990	5.98	6.54	6.16
	1991	5.80	6.33	6.07
	1992	6.21	6.23	6.22
	1993	6.09	6.52	6.25
	1994	6.20	6.28	6.24
	1995	5.78	6.55	6.11
	1996	5.98	6.27	6.13
	1997	5.99	6.21	6.09
	1998	5.61	6.13	5.87
	1999	5.74	6.19	6.00
	2000	5.86	6.11	5.98
UPTON BK	1989	4.89	4.98	4.93

Table 5.**HIGHLAND LAKE, NORTH
STODDARD**

**Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO₃.**

Epilimnetic Values

Year	Minimum	Maximum	Mean
1988	1.70	1.80	1.75
1989	2.00	2.30	2.17
1990	1.30	1.80	1.50
1991	1.90	2.00	1.95
1992	1.80	2.20	2.00
1993	1.30	2.00	1.75
1994	1.70	2.00	1.83
1995	2.40	28.40	11.17
1996	1.60	2.30	1.95
1997	1.70	5.30	2.63
1998	1.50	2.70	2.38
1999	1.60	2.20	1.83
2000	1.40	2.20	1.88

Table 6.**HIGHLAND LAKE, NORTH
STODDARD****Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
BARDEN POND BK	1988	21.1	24.8	22.9
	1989	20.3	22.4	21.3
	1990	18.8	22.5	21.1
	1991	20.8	24.7	22.9
	1992	19.8	20.3	20.1
	1993	21.9	26.4	23.9
	1994	20.8	23.3	22.4
	1995	19.9	23.8	21.4
	1996	21.8	26.5	24.0
	1997	19.9	23.8	22.1
	1998	17.5	21.3	20.0
	1999	21.8	28.2	24.7
	2000	18.2	24.9	21.2
BAZOCEN POND	1997	20.6	20.6	20.6
CARR BROOK	1989	24.8	32.3	28.5
	1990	25.2	28.5	26.4
	1991	24.6	35.0	29.2
	1992	23.9	25.5	24.7
	1993	26.4	29.7	28.5
	1994	26.2	29.8	28.4
	1995	23.7	28.8	25.4
	1996	22.9	28.3	25.5

Table 6.

**HIGHLAND LAKE, NORTH
STODDARD**

**Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
	1997	22.8	26.5	24.5
	1998	22.6	24.6	23.6
	1999	25.6	36.1	28.9
	2000	21.4	23.7	22.3
DAM COMPOSITE				
	1997	40.7	49.7	44.8
DAM OUTLET				
	1989	31.9	33.9	32.7
	1990	29.1	31.9	30.6
DAM				
	2000	18.3	18.3	18.3
DEAD BROOK				
	1989	41.3	50.5	45.9
	1990	36.2	46.0	42.2
	1991	41.4	50.9	45.1
	1992	45.4	57.7	52.2
	1993	55.9	57.5	56.5
	1994	41.7	46.2	44.6
	1995	43.8	55.5	50.7
	1996	42.9	49.5	47.4
	1997	47.0	65.8	54.2
	1998	37.4	45.0	41.8
	1999	35.1	79.2	58.5
	2000	48.9	55.2	51.3

Table 6.

**HIGHLAND LAKE, NORTH
STODDARD**

**Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
EPILIMNION	1988	27.7	29.6	28.6
	1989	31.9	33.6	32.7
	1990	29.6	31.9	30.8
	1991	30.5	30.7	30.6
	1992	31.4	36.3	34.3
	1993	31.8	33.4	32.5
	1994	30.0	33.3	32.0
	1995	36.0	37.1	36.4
	1996	32.9	33.6	33.2
	1997	30.6	31.2	31.0
	1998	29.8	33.7	31.2
	1999	33.1	34.9	33.9
	2000	31.8	34.4	33.1
FREEZELAND BK	1989	20.2	25.1	22.2
	1990	17.1	24.8	20.0
	1991	18.7	40.3	29.5
	1997	18.2	18.2	18.2
HYPOLIMNION	1988	28.1	29.7	28.9
	1989	36.5	39.0	37.9
	1990	33.3	42.6	36.7
	1991	30.9	33.5	32.2
	1992	36.2	39.7	37.8

Table 6.

**HIGHLAND LAKE, NORTH
STODDARD**

**Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
	1993	33.3	38.6	35.4
	1994	30.3	54.7	39.3
	1995	37.3	42.7	39.5
	1996	33.5	35.1	34.3
	1997	31.2	34.0	32.4
	1998	30.1	35.1	32.0
	1999	34.6	39.3	37.0
	2000	37.1	45.1	39.2
KENNEDY BK				
	1989	32.1	40.6	36.3
	1990	19.6	21.1	20.2
	1991	20.7	22.2	21.4
	1992	19.5	20.2	19.7
	1993	21.3	23.6	22.1
	1994	20.1	22.6	21.6
	1995	18.6	20.8	19.9
	1996	21.0	37.1	28.7
	1997	20.0	20.4	20.2
	1998	16.3	21.3	18.8
	1999	19.3	27.9	23.5
	2000	17.6	20.3	19.1
METALIMNION				
	1988	29.8	30.3	30.0
	1989	32.5	35.4	34.3
	1990	31.1	31.8	31.4

Table 6.

**HIGHLAND LAKE, NORTH
STODDARD**

**Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
	1991	31.0	31.0	31.0
	1992	33.2	39.1	35.8
	1993	32.4	33.5	33.1
	1994	32.2	36.9	33.9
	1995	36.5	38.7	37.7
	1996	32.9	33.4	33.1
	1997	30.9	32.1	31.4
	1998	30.7	33.5	32.1
	1999	33.0	34.2	33.7
	2000	32.2	35.4	34.1
N OF HIDDEN LAKE RD				
	1997	18.3	18.3	18.3
NEW NORTH OUTLET				
	1991	23.4	23.4	23.4
NORTH COMPOSITE				
	1996	51.3	51.3	51.3
	1997	69.6	69.6	69.6
NORTH INLET				
	1988	35.9	37.2	36.6
	1989	34.2	39.8	37.8
	1990	28.7	39.3	35.6
	1991	40.0	42.3	41.5
	1992	40.7	49.4	45.6
	1993	46.5	75.3	57.2
	1994	38.1	43.2	41.5

Table 6.

**HIGHLAND LAKE, NORTH
STODDARD**

**Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
	1995	42.6	46.9	44.4
	1996	40.5	46.7	43.4
	1997	34.8	52.0	43.6
	1998	38.8	47.0	43.6
	1999	44.6	117.9	71.7
	2000	37.2	50.3	43.8
NORTH OUTLET				
	1989	28.3	28.6	28.4
OUTLET COVE				
	1997	29.0	29.0	29.0
OUTLET				
	1988	28.4	28.5	28.4
PICKEREL COVE BK				
	1988	19.4	19.8	19.6
	1989	19.5	21.7	20.4
	1990	18.5	20.3	19.6
	1991	20.2	21.5	20.9
	1996	20.3	22.6	21.1
	1997	19.1	25.9	20.9
	1998	18.2	19.9	18.8
	1999	18.8	29.7	22.5
	2000	17.1	22.1	19.2
RICE BK TRIB				
	1996	21.4	44.7	30.0
	1998	17.8	30.8	26.1

Table 6.

**HIGHLAND LAKE, NORTH
STODDARD**

**Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
	1999	20.4	34.2	26.5
	2000	23.2	31.6	26.7
RICE BK				
	1990	18.5	20.8	19.7
	1991	17.5	20.4	19.0
	1992	17.8	19.3	18.6
	1993	19.1	20.4	19.7
	1994	18.6	20.1	19.2
	1995	19.5	32.4	23.9
	1996	23.0	42.6	29.4
	1997	21.7	22.4	22.0
	1998	18.0	19.7	18.9
	1999	20.7	30.7	24.1
	2000	14.4	19.5	17.7
UPTON BK				
	1989	17.7	18.2	17.9

Table 8.

**HIGHLAND LAKE, NORTH
STODDARD**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
BARDEN POND BK	1988	11	23	17
	1989	1	11	7
	1990	4	16	11
	1991	10	13	11
	1992	5	8	7
	1993	11	19	14
	1994	15	24	18
	1995	9	17	12
	1996	10	26	15
	1997	6	24	13
	1998	6	38	15
	1999	6	8	7
	2000	6	38	16
BAZOCEN POND	1997	10	10	10
CARR BROOK 2	1998	19	19	19
CARR BROOK	1989	16	35	25
	1990	16	29	22
	1991	11	29	22
	1992	12	23	16
	1993	23	75	47
	1994	12	40	28

Table 8.

**HIGHLAND LAKE, NORTH
STODDARD**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
	1995	11	29	18
	1996	24	65	39
	1997	22	39	27
	1998	9	26	18
	1999	17	31	23
	2000	11	33	18
DAM COMPOSITE				
	1996	13	13	13
	1997	23	88	55
DAM OUTLET				
	1989	12	19	16
	1990	11	16	14
DAM				
	2000	8	8	8
DEAD BROOK				
	1989	27	66	46
	1990	7	40	20
	1991	13	17	15
	1992	9	17	13
	1993	17	29	23
	1994	17	35	26
	1995	12	66	31
	1996	15	44	23
	1997	15	24	19
	1998	7	27	14

Table 8.

**HIGHLAND LAKE, NORTH
STODDARD**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
	1999	10	18	14
	2000	10	19	14
EPILIMNION	1988	12	18	15
	1989	3	29	16
	1990	12	18	14
	1991	6	13	9
	1992	10	14	12
	1993	7	11	9
	1994	7	12	9
	1995	7	15	11
	1996	9	15	12
	1997	8	16	12
	1998	8	39	16
	1999	5	9	7
	2000	6	13	8
FREEZELAND BK	1989	10	48	28
	1990	23	64	45
	1991	18	42	30
	1997	18	18	18
HYPOLIMNION	1988	9	18	13
	1989	18	44	27
	1990	23	30	26

Table 8.

**HIGHLAND LAKE, NORTH
STODDARD**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
	1991	10	14	12
	1992	11	16	14
	1993	8	68	29
	1994	10	38	27
	1995	13	17	15
	1996	9	24	15
	1997	12	84	38
	1998	8	27	14
	1999	10	59	34
	2000	8	68	32
KENNEDY BK	1989	20	34	27
	1990	7	16	11
	1991	10	18	13
	1992	5	14	10
	1993	13	21	18
	1994	11	16	13
	1995	8	13	10
	1996	11	14	11
	1997	1	11	7
	1998	12	31	17
	1999	8	18	12
	2000	< 5	18	9
METALIMNION	1988	11	17	14

Table 8.

**HIGHLAND LAKE, NORTH
STODDARD**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
	1989	7	19	13
	1990	13	13	13
	1991	8	8	8
	1992	10	13	11
	1993	9	19	14
	1994	7	18	13
	1995	8	14	10
	1996	9	13	11
	1997	9	31	18
	1998	9	16	12
	1999	6	7	6
	2000	6	19	9
N OF HIDDEN LAKE RD				
	1996	29	29	29
NEW NORTH OUTLET				
	1991	18	18	18
NORTH COMPOSITE				
	1996	12	12	12
	1997	16	16	16
NORTH INLET				
	1988	11	13	12
	1989	1	24	11
	1990	10	12	11
	1991	9	14	11
	1992	8	11	10

Table 8.

**HIGHLAND LAKE, NORTH
STODDARD**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
	1993	6	10	8
	1994	12	16	14
	1995	8	15	12
	1996	8	14	11
	1997	7	25	13
	1998	3	15	9
	1999	10	98	41
	2000	7	11	9
NORTH OUTLET				
	1989	10	32	21
OUTLET				
	1988	11	26	18
PICKEREL COVE 2				
	1998	24	24	24
PICKEREL COVE BK				
	1988	30	61	45
	1989	16	43	29
	1990	16	47	35
	1991	26	45	36
	1996	22	42	29
	1997	19	46	29
	1998	13	21	17
	1999	15	24	20
	2000	15	30	23

Table 8.

**HIGHLAND LAKE, NORTH
STODDARD**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
REAR OF HENDERSON RD				
	1996	36	36	36
RICE BK TRIB				
	1996	10	86	49
	1997	26	26	26
	1998	8	17	12
	1999	8	41	25
	2000	10	12	11
RICE BK				
	1990	21	43	29
	1991	25	32	27
	1992	12	21	17
	1993	30	35	32
	1994	22	94	48
	1995	18	64	34
	1996	10	39	23
	1997	17	42	32
	1998	12	30	23
	1999	13	35	25
	2000	15	26	21
UPTON BK				
	1989	19	29	24

Table 9.
HIGHLAND LAKE, NORTH
STODDARD

Current year dissolved oxygen and temperature data.

Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
August 14, 2000			
0.1	22.2	7.2	82.3
1.0	22.1	7.2	82.0
2.0	22.1	7.1	81.4
3.0	22.1	7.1	81.1
4.0	21.4	4.8	54.4
5.0	19.2	2.7	29.1
6.0	17.2	0.2	2.3
7.0	14.4	0.3	2.7
8.0	12.7	0.4	3.5

Table 10.

**HIGHLAND LAKE, NORTH
STODDARD**

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
June 16, 1988	9.0	11.2	-0.5	-3.0
June 13, 1989	5.5	12.0	2.8	26.0
August 8, 1989	8.0	10.1	0.0	0.0
July 10, 1990	8.0	12.9	0.7	6.6
June 25, 1991	8.5	13.2	0.2	1.9
June 10, 1992	8.0	9.9	1.8	15.9
June 30, 1993	8.0	12.7	1.8	16.0
September 13, 1993	8.5	13.0	0.5	5.0
July 25, 1994	7.5	13.1	0.1	1.0
June 16, 1995	8.5	11.0	3.0	27.0
June 28, 1996	8.0	12.0	1.5	14.0
August 18, 1997	7.5	17.0	2.0	21.0
August 17, 1998	8.0	13.0	0.2	2.0
August 14, 2000	8.0	12.7	0.4	3.5

Table 11.

**HIGHLAND LAKE, NORTH
STODDARD**

**Summary of current year and historic turbidity sampling.
Results in NTU's.**

Station	Year	Minimum	Maximum	Mean
BARDEN POND BK	1997	0.2	5.3	1.9
	1998	0.2	4.1	1.3
	1999	0.3	0.5	0.3
	2000	0.1	7.5	2.1
BAZOCEN POND	1997	0.5	0.5	0.5
CARR BROOK	1997	0.5	1.1	0.8
	1998	0.7	0.7	0.7
	1999	0.6	3.6	1.4
	2000	0.3	1.7	0.7
DAM COMPOSITE	1997	1.1	5.5	3.0
DAM	2000	0.4	0.4	0.4
DEAD BROOK	1993	0.0	0.0	0.0
	1997	0.6	1.3	0.9
	1998	0.6	2.2	1.3
	1999	0.6	1.1	0.9
	2000	0.7	1.0	0.8
EPILIMNION	1997	0.4	0.6	0.5
	1998	0.4	1.5	0.9

Table 11.

**HIGHLAND LAKE, NORTH
STODDARD**

**Summary of current year and historic turbidity sampling.
Results in NTU's.**

Station	Year	Minimum	Maximum	Mean
FREEZELAND BK	1999	0.4	0.5	0.4
	2000	0.4	0.7	0.5
	1997	0.5	0.5	0.5
HYPOLIMNION	1997	0.4	5.6	2.1
	1998	0.5	2.1	1.3
	1999	0.7	11.1	4.9
	2000	2.0	16.1	9.3
KENNEDY BK	1997	0.4	0.5	0.4
	1998	0.4	3.5	1.5
	1999	0.5	1.9	0.9
	2000	0.2	2.2	0.7
METALIMNION	1997	0.4	1.5	0.8
	1998	0.5	8.7	3.0
	1999	0.4	0.5	0.4
	2000	0.4	1.1	0.8
N OF HIDDEN LAKE RD	1997	0.6	0.6	0.6
NORTH COMPOSITE	1997	2.0	2.0	2.0
NORTH INLET	1997	0.3	0.6	0.4

Table 11.

**HIGHLAND LAKE, NORTH
STODDARD**

**Summary of current year and historic turbidity sampling.
Results in NTU's.**

Station	Year	Minimum	Maximum	Mean
	1998	0.5	1.7	0.9
	1999	0.4	1.1	0.6
	2000	0.3	1.0	0.6
OUTLET COVE				
	1997	0.5	0.5	0.5
PICKEREL COVE BK				
	1997	0.3	1.5	0.8
	1998	0.4	1.8	1.1
	1999	0.5	1.1	0.8
	2000	0.6	1.3	0.9
RICE BK TRIB				
	1998	0.6	0.8	0.7
	1999	0.4	1.7	1.1
	2000	0.2	0.8	0.4
RICE BK				
	1997	2.5	2.6	2.5
	1998	0.5	2.3	1.5
	1999	1.0	2.3	1.5
	2000	0.5	1.1	0.8

Table 12.

**HIGHLAND LAKE, NORTH
STODDARD**

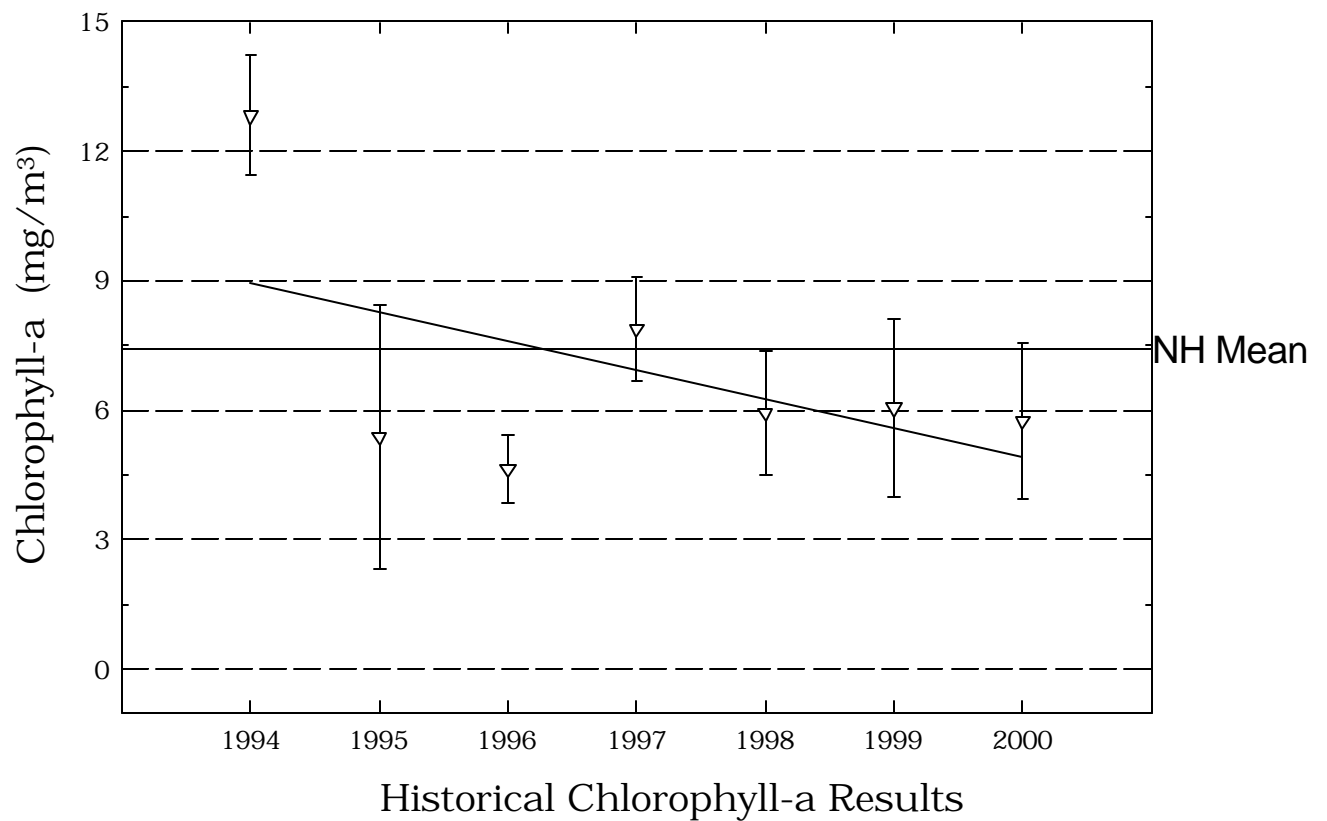
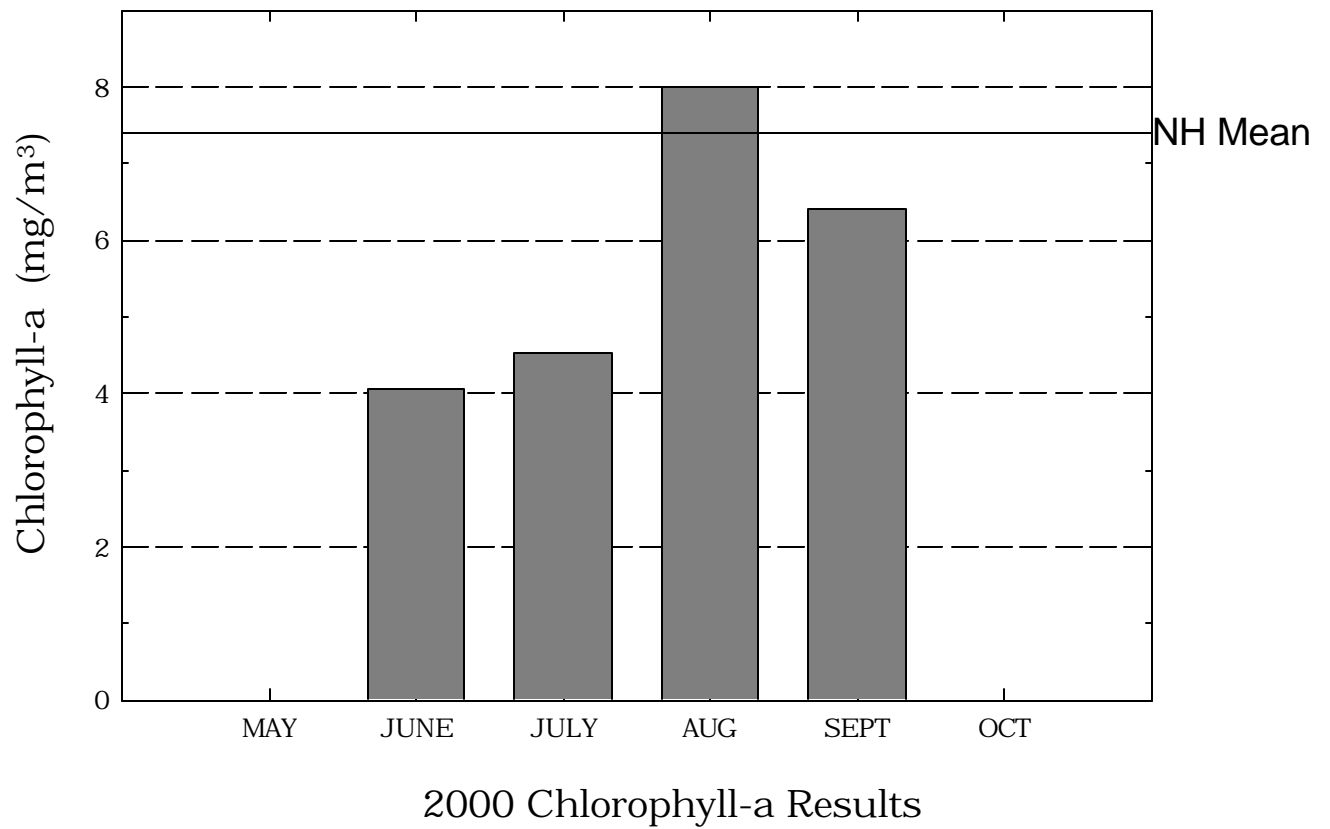
**Summary of current year bacteria sampling.
Results in counts per 100ml.**

Location	Date	E. Coli <small>See Note Below</small>
BOAT LANDING	June 25	13
CARR BROOK BACTERIA	July 16	0
CARR BROOK	June 25	10
	September 17	15
NORTH END OF COVE	June 25	4
SITE 1 HERMIT	August 30	1
SITE 2 WEST	August 30	9
SITE 3	August 30	1
SITE 4 ISLAND WEST SIDE	August 30	0
SITE 5 NORTH INLET	August 30	2
SOUTH COVE BOAT LANDING	July 16	0
SOUTH COVE NORTH END	July 16	31

NOTE: "<" means "less than" and ">" means "greater than"

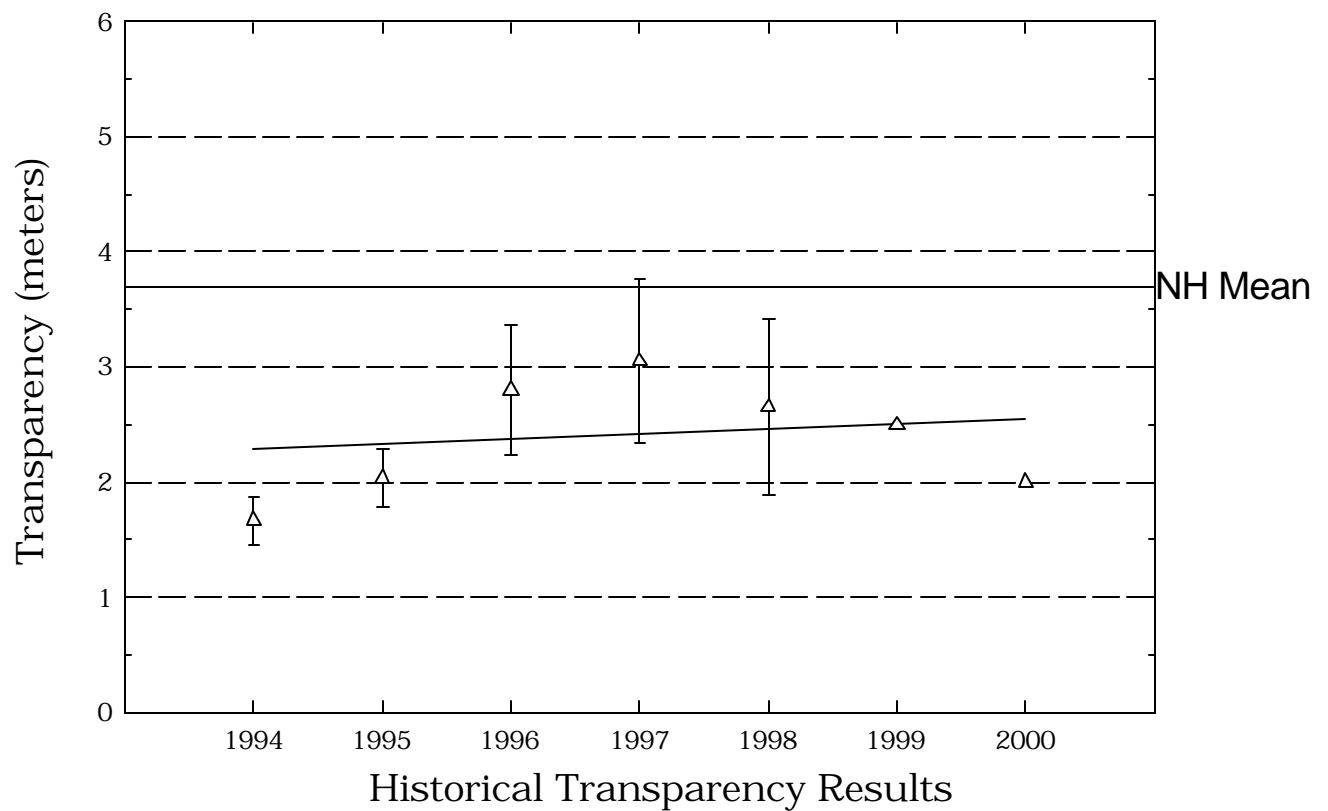
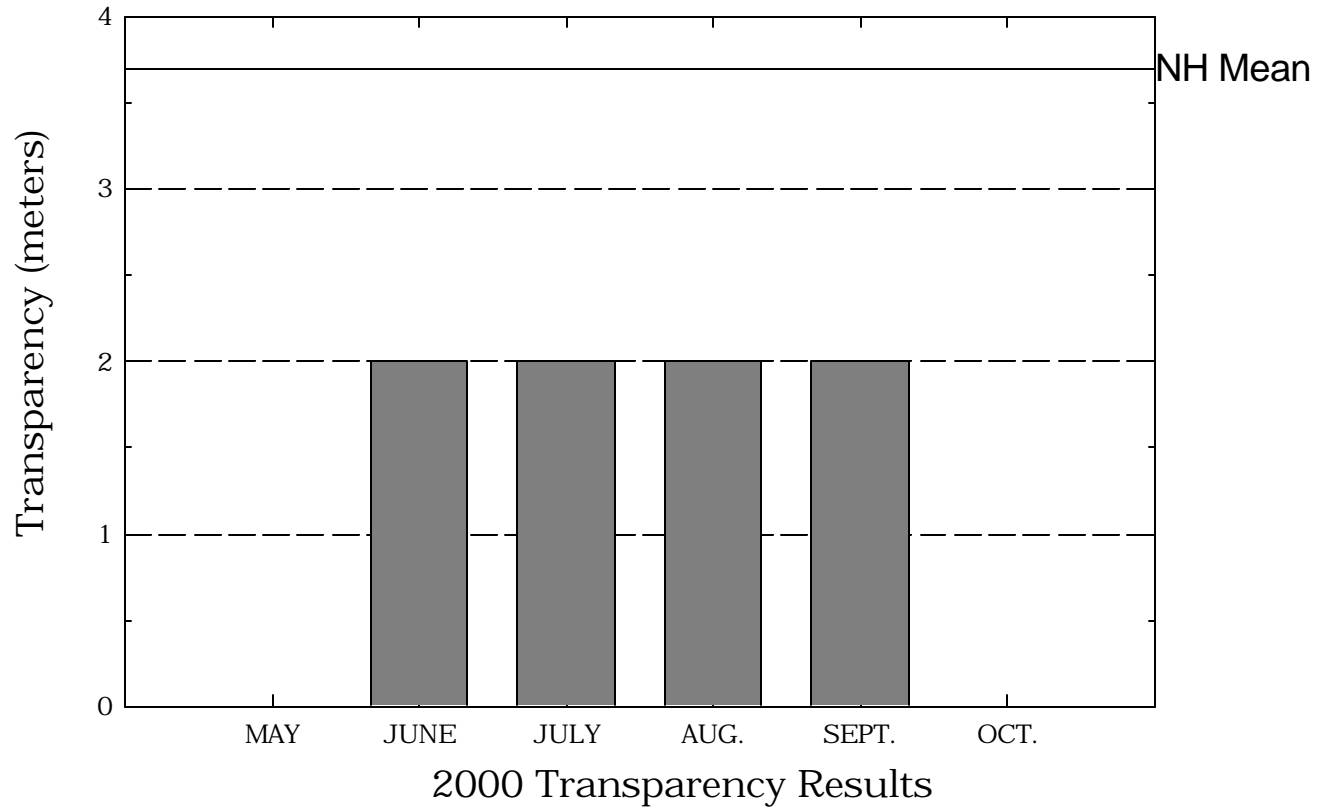
Highland Lake, South Station

Figure 1. Monthly and Historical Chlorophyll-a Results



Highland Lake, South Station

Figure 2. Monthly and Historical Transparency Results



Highland Lake, South Station

Figure 3. Monthly and Historical Total Phosphorus Data.

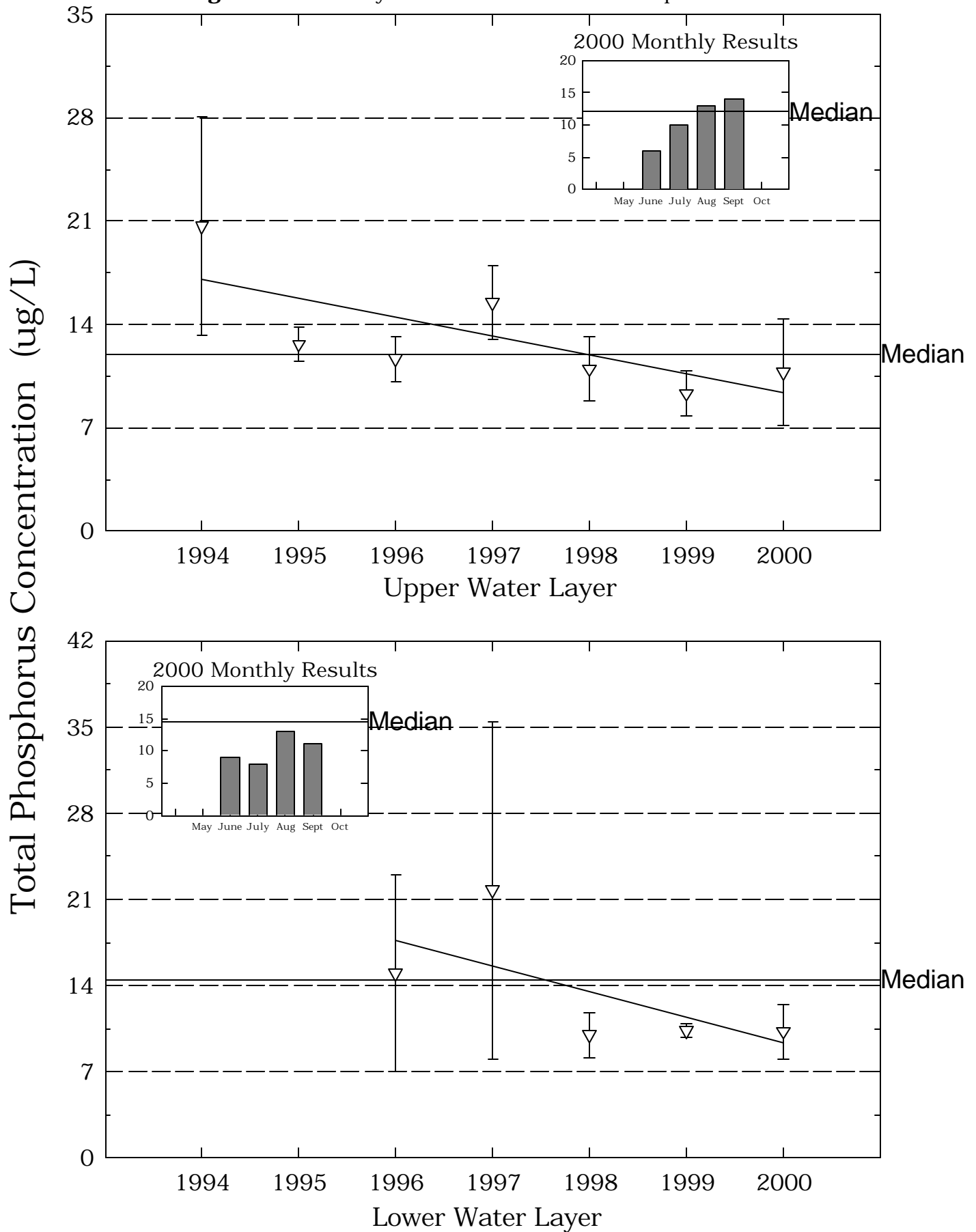


Table 1.**HIGHLAND LAKE, SOUTH
STODDARD****Chlorophyll-a results (mg/m³) for current year and historical
sampling periods.**

Year	Minimum	Maximum	Mean
1994	11.87	14.43	12.82
1995	3.22	7.54	6.10
1996	3.98	5.76	4.63
1997	6.78	9.15	7.87
1998	4.55	7.61	5.92
1999	3.67	7.35	6.05
2000	4.05	8.01	5.75

Table 2.

**HIGHLAND LAKE, SOUTH
STODDARD**

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
07/25/1994	TABELLARIA	39
	DINOBRYON	23
	ASTERIONELLA	15
06/16/1995	DINOBRYON	29
	CHRYSOSPHAERELLA	18
	MALLOMONAS	17
06/16/1995	DINOBRYON	29
	CHRYSOSPHAERELLA	18
	MALLOMONAS	17
06/28/1996	ASTERIONELLA	38
	DINOBRYON	15
	MALLOMONAS	15
08/17/1997	SYNURA	53
	MICROCYSTIS	14
	TABELLARIA	10
08/16/1998	CHRYSOSPHAERELLA	33
	ASTERIONELLA	26
	MALLOMONAS	15
08/13/2000	CHRYSOSPHAERELLA	70
	RHIZOLENIA	11
	TABELLARIA	6

Table 3.**HIGHLAND LAKE, SOUTH
STODDARD****Summary of current and historical Secchi Disk
transparency results (in meters).**

Year	Minimum	Maximum	Mean
1994	1.5	1.9	1.6
1995	1.8	2.3	1.9
1996	2.2	3.5	2.8
1997	2.5	4.0	3.0
1998	2.0	3.5	2.6
1999	2.5	2.5	2.5
2000	2.0	2.0	2.0

Table 4.**HIGHLAND LAKE, SOUTH
STODDARD**

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
EPILIMNION	1994	6.17	6.32	6.23
	1995	6.16	6.45	6.29
	1996	5.91	6.55	6.16
	1997	6.05	6.19	6.11
	1998	5.99	6.29	6.10
	1999	5.84	6.18	5.94
	2000	5.13	6.23	5.63
HYPOLIMNION	1996	5.54	6.00	5.71
	1997	5.71	6.10	5.95
	1998	5.86	6.19	5.98
	1999	5.99	6.09	6.03
	2000	5.85	6.11	5.99
SOUTH COMPOSITE	1996	9.55	9.55	9.52
	1997	9.27	9.27	9.30

Table 5.

**HIGHLAND LAKE, SOUTH
STODDARD**

**Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO₃.**

Epilimnetic Values

Year	Minimum	Maximum	Mean
1994	1.60	1.80	1.67
1995	2.20	2.80	2.50
1996	1.90	2.50	2.13
1997	1.10	2.30	1.65
1998	1.30	9.93	3.58
1999	1.70	2.60	2.03
2000	0.10	2.00	1.50

Table 6.**HIGHLAND LAKE, SOUTH
STODDARD****Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
EPILIMNION	1994	26.9	29.5	28.6
	1995	30.0	33.3	32.2
	1996	29.2	31.2	30.4
	1997	26.7	28.9	27.9
	1998	26.6	27.4	27.1
	1999	29.9	30.8	30.4
	2000	27.5	31.6	29.6
HYPOLIMNION	1996	28.9	31.5	30.3
	1997	26.7	28.3	27.7
	1998	26.7	28.4	27.8
	1999	30.3	31.2	30.6
	2000	26.8	29.9	28.5
SOUTH COMPOSITE	1996	53.1	53.1	53.1
	1997	47.9	47.9	47.9

Table 8.

**HIGHLAND LAKE, SOUTH
STODDARD**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
EPILIMNION	1994	15	29	20
	1995	12	14	12
	1996	10	13	11
	1997	12	18	15
	1998	9	14	11
	1999	8	11	9
	2000	6	14	10
HYPOLIMNION	1996	10	27	15
	1997	12	42	21
	1998	8	12	10
	1999	10	11	10
	2000	8	13	10
SOUTH COMPOSITE	1996	12	12	12
	1997	26	30	28

Table 9.
HIGHLAND LAKE, SOUTH
STODDARD

Current year dissolved oxygen and temperature data.

Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
August 14, 2000			
0.1	21.3	7.0	78.5
1.0	21.2	7.0	78.9
2.0	21.2	7.1	79.7
2.5	21.2	7.2	80.5

Table 10.**HIGHLAND LAKE, SOUTH
STODDARD****Historic Hypolimnetic dissolved oxygen and temperature data.**

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
July 25, 1994	3.0	24.0	4.0	48.0
June 16, 1995	3.0	18.0	5.5	58.0
August 18, 1997	4.0	22.5	8.2	93.0
August 17, 1998	4.0	22.8	6.6	75.0
August 14, 2000	2.5	21.2	7.2	80.5

Table 11.**HIGHLAND LAKE, SOUTH
STODDARD****Summary of current year and historic turbidity sampling.
Results in NTU's.**

Station	Year	Minimum	Maximum	Mean
EPILIMNION	1997	0.6	1.0	0.9
	1998	0.5	1.5	0.9
	1999	0.6	0.8	0.7
	2000	0.5	0.7	0.6
HYPOLIMNION	1997	0.7	1.1	0.9
	1998	0.6	1.7	1.0
	1999	0.5	0.9	0.7
	2000	0.5	0.8	0.6
SOUTH COMPOSITE	1997	1.4	1.4	1.4

Table 12.

**HIGHLAND LAKE, SOUTH
STODDARD**

**Summary of current year bacteria sampling.
Results in counts per 100ml.**

Location	Date	E. Coli <small>See Note Below</small>
HORSE FARM MAIN LAKE	September 17	12